

1 In the claims:

2 1. A flex circuit for use in a fuel cell, the flex circuit, comprising:

3 a fuel-side flexible circuit, comprising:

4 a first flex substrate, wherein the first flex substrate comprises openings
5 through which pass liquid fuel,

6 a first porous layer adjacent the first flex substrate, the first porous layer
7 including a first catalyst layer,

8 an anode electrode between the first flex substrate and the first porous
9 layer, and

10 a boundary layer disposed adjacent the first porous layer, the boundary
11 layer preventing cross-over of the liquid fuel;

12 an air/water-side flexible circuit, disposed in parallel with the fuel-side flexible
13 circuit, comprising:

14 a second flex substrate, wherein the second flex substrate comprises
15 openings through which pass water,

16 a second porous layer adjacent the second flex substrate, the second
17 porous layer including a second catalyst layer, and

18 a cathode electrode between the second flex substrate and the second
19 porous layer; and

20 a center section disposed between the first and the second flex circuits, wherein
21 the first and the second flex substrates are conformable to non-planar shapes.

22 2. The flex circuit of claim 1, wherein the center section is a proton exchange
23 membrane.

24 3. The flex circuit of claim 1, wherein the center section is a channel carrying
25 dionized water, the center section further comprising spacers to maintain a separation
26 between the fuel-side flexible circuit and the air/water-side flexible circuit.

27 4. The flex circuit of claim 1, wherein the flex circuit is formed in a shape of a
28 cylinder.

29 5. The flex circuit of claim 4, wherein the liquid fuel is contained within an interior of
30 the cylindrical flex circuit.

- 1 6. The flex circuit of claim 4, wherein the liquid fuel is contained exterior to the
2 cylindrical flex circuit.
- 3 7. The flex circuit of claim 1, wherein the flex circuit is formed in a shape of a
4 polygon, and wherein the liquid fuel is contained within an interior of the polygon.
- 5 8. The flex circuit of claim 1, wherein the flex circuit is in a shape of a star having N
6 points, and wherein the liquid fuel is contained within an interior of the star-shaped flex
7 circuit.
- 8 9. The flex circuit of claim 1, wherein the first porous layer comprises a plurality
9 of pores oriented in a vertical direction and approximately parallel to a local plane
10 defined by the first porous layer, wherein a size one or more of the plurality of the pores
11 is chosen such that the liquid fuel is transported to near a top vertical limit of the one or
12 more pores by capillary action.
- 13 10. The flex circuit of claim 1, wherein the first and the second porous layers
14 comprise porous metal.
- 15 11. The flex circuit of claim 10, wherein the metal is chosen from the group
16 consisting of zinc and silver.
- 17 12. A flex-based fuel cell, comprising:
18 a first flexible circuit; comprising:
19 a first flexible substrate, and
20 a porous metal/catalyst layer, wherein the porous metal/catalyst layer
21 comprises a plurality of pores oriented to distribute fuel to substantially all of the first
22 flexible circuit using a capillary action;
23 a separation section adjacent the first flexible circuit; and
24 a second flexible circuit adjacent the separation circuit, wherein the first and the
25 second flexible circuits are conformable to a substantially non-planar shape.
- 26 13. The flex-based fuel cell of claim 12, wherein the separation section is a proton
27 exchange membrane.
- 28 14. The flex-based fuel cell of claim 12, wherein the separation section is a channel
29 comprising dionized water.
- 30 15. The flex-based fuel cell of claim 12, wherein the substantially non-planar shape

comprises a cylinder.

16. The flex-based fuel cell of claim 15, wherein an interior of the cylindrical flex-based fuel cell comprises liquid fuel.

17. The flex-based fuel cell of claim 16, wherein the liquid fuel is methanol.

18. The flex-based fuel cell of claim 12, further comprising a dry film adhesive disposed between the first flexible substrate and the second flexible substrate.

19. A flex-based fuel cell, comprising:

means for converting liquid fuel to protons, comprising:

means for transporting liquid fuel through the liquid fuel converting

means, and

first means for flexibly supporting the liquid fuel converting means;

means for receiving the protons, comprising:

means for converting the protons to water vapor, and

second means for flexibly supporting the proton converting means; and

means for exchanging the protons from the liquid fuel converting means to the proton converting means.

20. The flex-based fuel cell of claim 19, wherein the liquid fuel transporting means comprises a porous metal layer having means for causing capillary transport of the liquid fuel within the porous metal layer.

21. The flex-based fuel cell of claim 19, wherein the proton exchanging means comprises a proton exchange membrane.

22. The flex-based fuel cell of claim 19, wherein the proton exchanging means comprises a dionized water channel.

23. A method of preparing a flex circuit for a fuel cell, comprising:

patterning a conductive material on flex supporting means having a front surface and a back surface, wherein the conductive material is patterned on the front surface;

attaching a layer of porous material to the conductive material;

depositing a layer of catalytic coating on the surface of the porous material; and

ablating the supporting means from the back surface to make openings so that the porous material is exposed.

- 1 24. The method of claim 23, further comprising the step of coating the catalyst layer
2 with a thin layer of proton transfer membrane.

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